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Pekin and Lamarsh
Drainage and Levee District

Civil Engineering

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**PEKIN AND LAMARSH
DRAINAGE AND LEVEE DISTRICT**

BY

HOWARD CHARLES HAUNGS

THESIS

FOR

DEGREE OF BACHELOR OF SCIENCE


IN

CIVIL ENGINEERING

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C O L L E G E O F E N G I N E E R I N G

May 25, 1907.

This is to certify that the following thesis prepared under the immediate direction of Mr. Harry Gardner, Instructor in Civil Engineering, by

HOWARD CHARLES HAUNGS

entitled PEKIN AND LAMARSH DRAINAGE AND LEVEE DISTRICT

is accepted by me as fulfilling this part of the requirements for the Degree of Bachelor of Science in Civil Engineering.

----- *Ira C. Baker.* -----

Head of Department of Civil Engineering

Pekin and Lamarsh
Drainage and Levee District.

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Description

The Pekin and Lamarch Drainage and Levee District is situated about ten miles below Peoria, Illinois, and lies between the West bank of the Illinois River on the South and Southeast and the bluffs on the Northwest, and extends from the Peoria and Pekin Union Railway embankment on the East to Lamarch Creek on the West. The tract comprises between 2400 and 2500 acres lying within Sections 13-14-15-22-23-25-26 and 27, Township 7 North, Range 7 East of the 4th P. M., Peoria County, Illinois, and directly across the Illinois River from the city of Pekin. Nearly all of the land included within the District is subject to overflow by the high waters of the Illinois River and, excepting those lands that have been protected from such overflows by previously constructed levees, a considerable portion is subject to overflow by the high waters of Lamarch Creek. The soil in the

river bottoms is very rich consisting to a considerable depth of decomposed vegetable matter mixed with the silt deposited by the flood waters, and when sufficiently drained becomes excellent and valuable farm land, yielding abundant quantities of corn, wheat and other agricultural produce.

Legal Considerations

The steps necessary for the legal organization and acquirement of corporate power, and for the execution of the proposed work for a drainage district, according to the laws of Illinois, are here briefly summarized. [Revised Statutes of Illinois - 1905 - Ford.]

1. Filing with the County Court by a majority of the owners of the land, representing at least one-third ($\frac{1}{3}$) of the area included within the proposed district, a petition for the improvement.
2. Hearing on the petition and the appointment of three (3) competent

commissioners by the Court.

3. Organization of the Commissioners and their investigation as to the practicability of the improvements requested in the petition, and the estimate of the cost.

4. Report to the Court of the conclusions of the Commissioners.

5. Hearing by the Court on the report and its confirmation.

6. Appointment by the Court of twelve (12) jurors who personally inspect the land and make the assessment of damages and benefits.

7. Hearing on the assessment roll and the confirmation of the same.

8. Bond issue not to exceed ninety (90) per cent of the unpaid assessments.

9. Final detail plans, letting the contract and the prosecution of the work.

The law requires the Commissioners to determine and report to the Court:-

- (a) Feasibility of the work and improvements
- (b) Probable cost of the contemplated

improvement including all incidentals and cost of proceedings.

(c) Probable annual cost of maintenance.

(d) What lands, if any, will be injured or damaged by the proposed work and the probable aggregate amount of damages.

(e) What lands will be benefited, and whether the aggregate amount of benefits will exceed the cost of constructing such work including damages and incidental expenses.

(f) Whether the proposed district will embrace all the lands benefited or damaged.

(g) Whether the aggregate annual amount of benefits will equal or exceed the annual costs of repairs, incidental expenses, and costs of proceedings.

(h) Whether work will be sufficient to protect permanently the said lands from overflow and drain the same.

Topographic Conditions

The Pekin and Lamarch Drainage and Sere District was organized in 1889, the petition presented August 13,

and the hearing held September 16, 1889 at the September term of the County Court of Peoria County, Illinois. Leander King, Michael M^cMorrow and J. D. McIntire were appointed Commissioners and on October 7 of the same year, they made their report to the Court. This showed the proposed work to be proper and feasible, with a cost of \$20 000 and an annual cost of 20 cents per acre. It proposed that; - the levee should be fifteen (15) feet above low water at the Pekin bridge with slopes of one (1) to one (1); the waterway of 1300 linear feet along the Peoria and Pekin Union Railway embankment between Hollis and the Illinois River should be filled up by earth and there should be an open ditch on the North side of the railroad embankment or right of way with six (6) foot bottom and of proper depth and slopes to drain the water; also another ditch of same dimensions from the said waterway to the levee near Lamarsh Creek.

Work was begun in the spring.

of 1890 and completed in the following year.

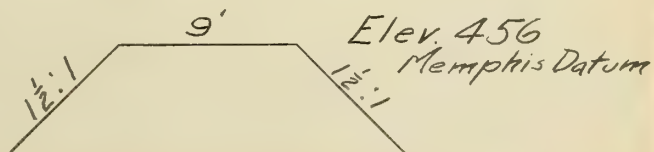
Levee. The old levee forming the enclosure for the protection against overflow begins at the high land at Hollis station near the North line of the Southwest quarter of the Southeast quarter of Section 11, Township 7 North, Range 7 East of the 4th P.M.; - thence extends in a Southeasterly direction across the valley to the Illinois River following the line of the Peoria and Pekin Union Railway Embankment to a point about 500 feet up stream from the Peoria end of the Pekin highway bridge; thence following the right bank of the Illinois River to a point near the West line of Section 27, said township and range; thence North to a point near the West quarter corner of Section 22, said township and range; thence in an irregular course having a general Northeasterly direction along the left bank of Lamarch Creek to the Toledo, Peoria and Western Railway bridge across Lamarch Creek;

thence in an irregular course in a Northwesterly direction following the left bank of Lamarsh Creek about one-half ($\frac{1}{2}$) mile and joining the high land on the Northwest quarter of the Southeast quarter of the Southwest quarter of Section 15, said township and range. The portion of the levee extending from Hollis to the river was formerly a road bed for the Peoria and Pekin Union Railway. This track was some years ago abandoned and the road bed has not since been used for railway purposes.

At the time of the organization of the Pekin and Lamarsh Drainage and Levee District, a part of this stretch of railroad was embankment and a part of it was trestle work constructed of timber piling, stringers and ties. On September 15, 1890 an agreement was entered into between the Commissioners of the District and the officers of the Peoria and Pekin Union Railway Company concerning the construction and maintenance of said embankment. The Peoria and Pekin Union Railway

granted the Commissioners the right to construct an open ditch of at least six (6) foot bottom and proper slopes along the Northerly line of the right of way from the trestle work next South of the junction at Hollis to the river, also to join the levee constructed along the river on the South with the railroad embankment. The Peoria and Pekin Union Railway agreed;:- within the year 1890, to completely embank and fill in the two (2) trestles in its railroad embankment southeast of Hollis by the construction of an embankment with a height the same as that of the cross ties then in the trestle work, with a width of nine (9) feet on top, and with side slopes of $1\frac{1}{2}$ to 1; to raise the grade of its tracks and embankment between Hollis and its bridge across the Illinois River at Pekin to the height of timbers on said trestle work and to maintain said grade and embankment, when so constructed, at its own expense.

Section of old
P.&P.U. embankment



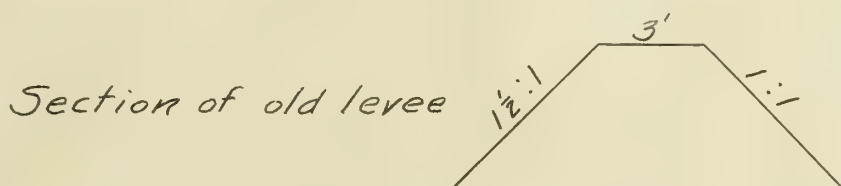
On the other hand, the Pekin and Lamark Drainage and Levee District agreed; - to save and keep harmless the Peoria and Pekin Union Railway from all loss, cost, damage and liability to any land, or the owners or occupants thereof, in the vicinity, occasioned by any overflow from filling in said trestles, digging said ditch or raising said embankment; to pay twelve (12) cents for each and every cubic yard of earth, or other substantial material commonly used in like work, put in the embankment above described, such payment to be made on completion of said embankment. In constructing the said embankment, the Peoria and Pekin Union Railway agreed to remove all logs, drift-wood and trash then at or under said trestle work except such articles at places where it constructed part of the embankment. In consideration of said agreement on the part of said railway company to maintain said embankment as a levee, the Commissioners of the Drainage District agreed that no assessment for benefits or maintenance

of the Drainage District should be made against said railway company.

The elevation of the top of the embankment was between 455 and 456 feet above Memphis Datum.

The Peoria and Pekin Union Railway proceeded to fill and had finished filling the openings in this embankment in accordance with the agreement as soon as the Commissioners had completed the remaining portion of the levee. Beginning at said railway embankment near the Illinois River, the Commissioners constructed a levee along the route heretofore described. The levee was built to an elevation of about 455 feet above Memphis Datum along the Illinois River and with an ascending grade along Lamark Creek, the average height of said levee being about nine (9) feet. The work was done with scrapers and the levee finished with a $1\frac{1}{2}$ to 1 slope on the river side, 1 to 1 slope on the inside, and a three (3) foot top. The foundation for the embankment was not prepared in any

way, stumps and logs being left, and in some instances trees not being even cut. Earth for building the levee was taken from both sides leaving borrow pits on both inside and outside of the levee.



As a result of this kind of construction there was a large amount of seepage through the levee near the base and through the underlying soil, which is more or less stratified and which furnished an easy means of filtration through the ground under said levee because of the parallel rows of borrow pits. These borrow pits, much of the time, are filled with water and are infested by musk rats which burrow in the levee and reduce its strength and durability.

For a number of years after the construction of the levee, the high waters of the Illinois River did not overflow

or affect it. But in 1902, the river was higher than for many preceeding years and overflowed and broke through the Peoria and Pekin Union Railway embankment flooding the entire Drainage District. The failure was caused by the cross ties in the embankment. In 1903 and 1904 extremely high waters again occurred in the Illinois River and, since the first break in 1902, none of the lands in the District have been cultivated, excepting small tracts on the Northerly side which are very near the high water line. During the high water, the District was practically a lake nearly two miles long and more than one mile wide. There was no timber nor other obstructions to wave action along the levee and the side of the levee was very severely damaged by being washed and cut down from the inside. The injury to the levee on the outside except, however, at places where the levee was actually overflowed, was comparatively small.

Ditches. The natural drainage of this tract of land was to the Southwest

through a series of depressions and a shallow channel emptying into the Illinois River. At the place where this channel was crossed by the levee, a sluice way four feet in diameter and a gate were constructed to be used in times of low water in the river, but this arrangement has been a continual source of danger and damage to the District. In order to drain the District in times of high water in the river, ditches constructed with scrapers connected the low places within the District to a pumping station.

Pumping Station. The pumping station was placed at the Southeast corner of the Drainage District near the Peoria end of the wagon bridge across the Illinois River at Pekin. This location was selected because of the easy access thereto for attendance and delivering coal. The plant consisted of a steam boiler and engine, and a Menger centrifugal pump with two wheels, having a capacity of 500 000 gallons per hour. The pump

was used to lift the water from the ditch and discharge it through a wooden flume over the levee into the river. The plant, however, has been out of commission since the high waters of 1902, which destroyed part of the levee and rendered most of the land within the District untillable on account of insufficient drainage.

Surveys, Plans & Profiles.

The petition of the property owners on file in the County Court suggests a plan for the improvement of the present levee. It proposes; - raising the Teoria and Pekin Union Railway embankment from Hollis to the Illinois River about two feet which would be to an elevation of 458 feet above Memphis Datum; and raising to the same elevation and strengthening the remaining portion of the levee, taking the dirt for the work entirely from the outside of the levee, placing it on the inside and top of the present levee,

and filling the present borrow pits on the inside of the levee. For the purpose of ascertaining the practicability and the cost of this plan of improvement, the Commissioners in 1905 directed a survey to be made by the Harman Engineering Company of Peoria, Illinois, in consequence of which, cross-sections at intervals of 100 feet throughout the length of the levee were made and the notes platted. The cross-sections extend from the water line of the Illinois River across the old levee and some distance beyond the borrow pit inside. A map of the Illinois River Survey was procured from the War Department of the United States which shows the topography of the Drainage District, the levels for which are referred to Memphis Datum. From the point, where the levee leaves the Illinois River and follows Lamarsh Creek, to the highway bridge across Lamarsh Creek in the Southwest quarter of the Southeast quarter of the Southwest quarter of Section 15, Township 7 North, Range 7 East of the 4th P. M., the cross-sections included Lamarsh Creek.

From this point to the end of the levee, which is used as a public highway, levels were taken on the top of the grade and cross-sections made at several points. Levels were also taken along the top of the Peoria and Pekin Union Railway embankment and the top of the Peoria and Pekin Terminal Railway grade from the Illinois River to Hollis.

The cross-sections were platted on eight sheets and on these the location of the new levee and the new channel of Lamarsh Creek, as proposed by the engineer, Mr. J. A. Harman, was made.

A general map of the Drainage District on a scale of 1 inch equals 400 feet was prepared on which was shown the Government sub-divisions of the land, the location of the public highways, of railroads, houses, fences, the location of the old levee and Lamarsh Creek channel, the center line of the proposed levee improvements, the side lines of the proposed new channel for Lamarsh Creek, and the lines of the proposed main open ditches.

Profiles of the new levee from the

end of the Peoria and Pekin Union Railway grade near the Illinois River, down the Illinois River and up Lamarch Creek are shown on one sheet. Upon these profiles are shown the surface of the ground and the grade line or top of the proposed levee. Profiles of the top of the Peoria and Pekin Union Railway grade, showing the condition thereof, and the top of the ties of the Peoria and Pekin Terminal Railway grade from Hollis to the Illinois River are shown on a second sheet. Profiles of the proposed ditches shown upon the general map of the District are drawn upon another sheet and show the surface of the ground and the grade line of the bottom of the proposed ditches.

Design

About 2400 acres of land in the District is subject to overflow from the Illinois River and the lower end of the District is subject to overflow from Lamarch Creek. Continuous records of the stage of the river have not been kept at Pekin,

but the height attained by some notable floods during the last 60 years has been determined from marks made at the time and the elevation of these points has been determined.

Table of Elevations of High Waters of the Illinois River at Pekin, referred to Memphis Datum.

Year	Elev.
1844	461.0
1904	455.2
1902	454.0
1883	454.0
1892	453.6

The elevation of the top of the old levee was between 455 and 456 feet and the flood of 1902, which broke the Peoria and Pekin Union Railway embankment, did not go over but was near the top and broke through. Experience has shown that any levee is in danger of breaking by saturation or wave action or both when the water remains less than three (3) feet from the top of the levee for more than a few hours.

Samarsh Creek drains about 30 square miles of land and has a fall of about

200 feet. The territory drained may be considered hilly and has many deep ravines. Rainfall consequently gathers into the streams very quickly and produces floods of considerable magnitude. The creek carries large quantities of sand and other detritus which is deposited on the overflowed areas at the foot of the hills in the Illinois River valley. If such a stream is to maintain its own channel, it must be so controlled that the main thread of the stream will follow the channel even in the highest flood. Otherwise banks and bars are formed at all points where the velocity is sufficiently reduced to permit sedimentation and, in this manner, the old channel is impeded and new means of egress develop. By reason of the restriction of the waterway available for floods, the levee along Lamarsh Creek from the wagon bridge up stream has frequently been overflowed, the water having flooded the Lamarsh Creek valley on the East side of the levee and washed out about one-half

($\frac{1}{2}$) mile of the Toledo, Peoria and Western Railway grade East of the creek. Similar damage to the railroad track has been repeated several times during the last three or four years.

For about one-half ($\frac{1}{2}$) mile below the Toledo, Peoria and Western Railway, Lamarsh Creek is confined to a narrow strip of land between the levee and the higher ground on the west. Through this strip the creek has maintained a fairly uniform channel but has built up the land between the levee and the creek so that it is from two to four feet higher than the adjoining land inside the levee. The problem with Lamarsh Creek, therefore, is to construct such a levee as will not be overflowed and such a channel as will carry the flood waters and not allow sediment to be deposited so as to obstruct the channel. Three or four years ago, the owners of the land adjacent to the west side of this District constructed a new channel for Lamarsh Creek from the Illinois

River up stream for a distance of nearly three-fourths ($\frac{3}{4}$) of a mile along the west line of Sections 27 and 28. This channel is about 30 feet wide and was constructed by a dipper dredge. The dirt excavated was deposited on both sides of the ditch.

The plan proposed provides for widening this channel from the Illinois River for a distance of about one-half ($\frac{1}{2}$) mile, throwing the dirt on the East side and thus forming a levee; thence continuing in the general course of Lamarsh Creek but making the channel as straight as practicable to the railroad bridge, a distance of about three-fourths ($\frac{3}{4}$) of a mile, the dirt to be thrown on the East side to form a levee. By this means a channel about 50 feet wide on the bottom will be made as far as the present excavated channel of Lamarsh Creek is followed, and a channel 40 feet wide thence to the Toledo, Peoria and Western Railway bridge. From this bridge to the wagon bridge, a distance of about 300 feet, the channel is to be

straightened and deepened. Between Hollis and Lamarsh Creek there are a few small ravines emerging from the hills and draining about 200 acres of land. Drainage from this land is admitted to the District and will be taken care of in the same manner as the rainfall upon the District.

Experience with levees along the Illinois River indicates the following general requirements :-

1. That the levee should be about three (3) feet higher than the maximum high water. It is necessary to have this additional height as a precaution against wave-action. Where there is any considerable space of open still water, the waves occasionally run three feet high, and if they go over the top of the levee there is grave danger of its destruction.

2. In cross-section, the levee should be at least three (3) feet wide at the top and have side slopes of not less than 3 feet horizontal to 1 foot vertical on the river side, and 2 feet horizontal to 1 foot

vertical on the land side.

3. All material for the levee must be taken from the out or river side and no borrow pits made upon the inside of the levee.

In the improvement to the Drainage District, the proposed levee conformed with the above requirements, and the high water of 1904 was taken as a basis. It was presumed that the conditions which existed throughout the entire Illinois River valley above Pekin in 1844 have been so changed by tillage and other drainage that there is little probability of the recurrence of such a flood. Besides, the additional expense to the District to build a levee high enough for the flood of 1844, in view of the improbability of its recurrence, would not be warranted. In making the estimates for the proposed improvements, the elevation to which the new levee was to be built from Hollis to the Illinois River and down the Illinois River to Lamarsh Creek, was 458 feet above Memphis Datum, or practically 3 feet above the high water mark of 1904.

Estimates were first made for rebuilding and strengthening the old levee from the road at the Pekin Highway bridge to its terminus. These estimates included filling all the old borrow pits inside the old levee. But the old levee is so close to the river in many places that it is impracticable to secure sufficient dirt on the outside to rebuild and strengthen it to the dimensions and amount required. The strip of land between the old levee and the river along most of the distance is covered with a heavy growth of brush and small timber which if left would serve as a protection to the levee, but would need to be removed to rebuild the old levee. Taking the advantages and disadvantages into consideration, the following plan was recommended by the engineer:— To build a new levee from the Pekin wagon road down the Illinois River to Lamarsh Creek and along the creek to the Toledo, Peoria and Western Railway grade; thence following the old levee about 400 up Lamarsh Creek to the public road; thence a new levee Northeasterly along the public road about

500 feet to the high land, leaving the old levee along Lamarch Creek at its present elevation; the levee along Lamarch Creek between the Toledo, Peoria and Western Railway and the wagon road to be raised so that it will be two feet higher at the Toledo, Peoria and Western Railway grade or at an elevation of 464 feet, and two feet higher at the wagon road than at the railroad, or at an elevation of 466 feet; from this point to the bluff the levee along the wagon road will be at an elevation of 466 feet. This plan contemplates raising the Toledo, Peoria and Western Railway bridge across Lamarch Creek two feet and raising the railroad tracks an equal amount where they cross the levee. It is expected to fully protect the Toledo, Peoria and Western Railway grade and the lands lying South and East of the wagon road crossing the Southeast quarter of the Southwest quarter of Section 15 but will leave a portion of the lands in Section 15 which are within the Drainage District without further protection than will be provided by the old levee

along Sammarsh Creek.

Since the organization of the Pekin and Sammarsh Drainage and Levee District, the Peoria and Pekin Terminal Railway Company has built a railroad track within the District from Hollis to the Illinois River parallel with and adjacent to the Peoria and Pekin Union Railway grade, which is used as a levee. The Peoria and Pekin Terminal track was submerged for several weeks in 1902 when the Peoria and Pekin Union levee broke. Since that time the Peoria and Pekin Terminal Railway has raised its embankment until the top of the ties are now at an elevation of about 457 feet. The proposed improvements provide that either the Peoria and Pekin Union Railway embankment shall be raised to an elevation of 458 feet and strengthened as a levee or that the Peoria and Pekin Terminal Railway grade shall be raised so that the bottom of the ties will be at an elevation of at least 458 feet. During the high water of the early part of 1905, this railroad

embankment suffered considerable damage and the railway company was put to a great expense to protect and maintain the embankment from destruction by wave action. At present, the Peoria and Pekin Terminal Railway Co. is required by agreement with the Commissioners of the District to maintain, without openings, their embankment with 9 foot top and side slopes of $1\frac{1}{2}$ feet horizontal to 1 foot vertical and in consideration are released from all assessments.

Owing to the amount of seepage which has occurred in the Drainage District, it was considered advisable to provide for a muck ditch throughout the length of the new levee. The muck ditch as proposed was to be not less than five (5) feet deep and not more than six (6) feet wide at the bottom, with side slopes as nearly vertical as practicable but not exceeding 1 foot horizontal to 1 foot vertical. The muck ditch is to be located at or near the center of the levee and will also serve to unite the embankment to the

earth.

A new pumping plant will be located where the old one is and some of the old ditches are to be enlarged and deepened and new ones constructed so that all the water within the District may be drained to the pumping station.

As no stream draining extraneous territory enters the District and the watershed recedes only a few hundred feet beyond the District, the problem of drainage is comparatively simple and involves only the rainfall upon the given area to be drained.

The following table is found in "Engineering for Land Drainage" by C. J. Elliott.

Areas	Rainfall over entire area
1000 - 3000 acres	$\frac{3}{4}$ " in 24 hours
3000 - 8000 "	$\frac{1}{2}$ " " " "
8000 - 30000 "	$\frac{1}{4}$ " " " "

A rainfall of $\frac{3}{8}$ " depth on 2650 acres every 24 hours, equivalent to .0157 cubic feet per second per acre, was assumed as maximum in the design of the ditches, and

the formulae used for estimating the required cross-section for the various ditches were, -

$$V = \sqrt{\frac{a}{p}} \times 1.49 \sqrt{f} \quad \text{and}$$

$$Q = aV$$

where V = mean velocity in feet per second

a = area of waterway

p = wetted perimeter

f = fall in feet per mile

Q = discharge in cubic feet per second.

The ditches were designed to be at least five (5) feet deep in the low places but are generally from six to eight.

Specifications.

The present Commissioners, W. D. Prettyman, Henry Ross, and H. W. Mattheesen, solicited bids for the construction of the levee and ditches for the aforesaid District and opened them on August 1, 1906.

The work was put in two divisions so that each division could be awarded separately or both to one contractor, the divisions comprising the following work:

- (1) Building the levee including the

excavation of the muck ditch and straightening and enlarging the channel of Lamarsh Creek.

(2) Excavating the interior drainage ditches.

The bids were based on yardage for different kinds of work as follows:-

(1) Fill for the levee and excavation for the enlargement of Lamarsh Creek channel from the Peoria and Pekin Union Railway grade to the Toledo, Peoria and Western Railway; - the yardage to be estimated in fill of levee, except where the excavation in the enlargement of Lamarsh Creek in any 100 foot interval be in excess of the amount required in the corresponding interval of the levee, in which case the specified excavation in the Lamarsh Creek channel will be used.

(2) Fill for that portion of the levee West of the Toledo, Peoria and Western Railway and extending to the high land and which is to be constructed from material to be borrowed from the Channel and banks of Lamarsh Creek immediately above and below the Toledo, Peoria and Western Railway bridge.

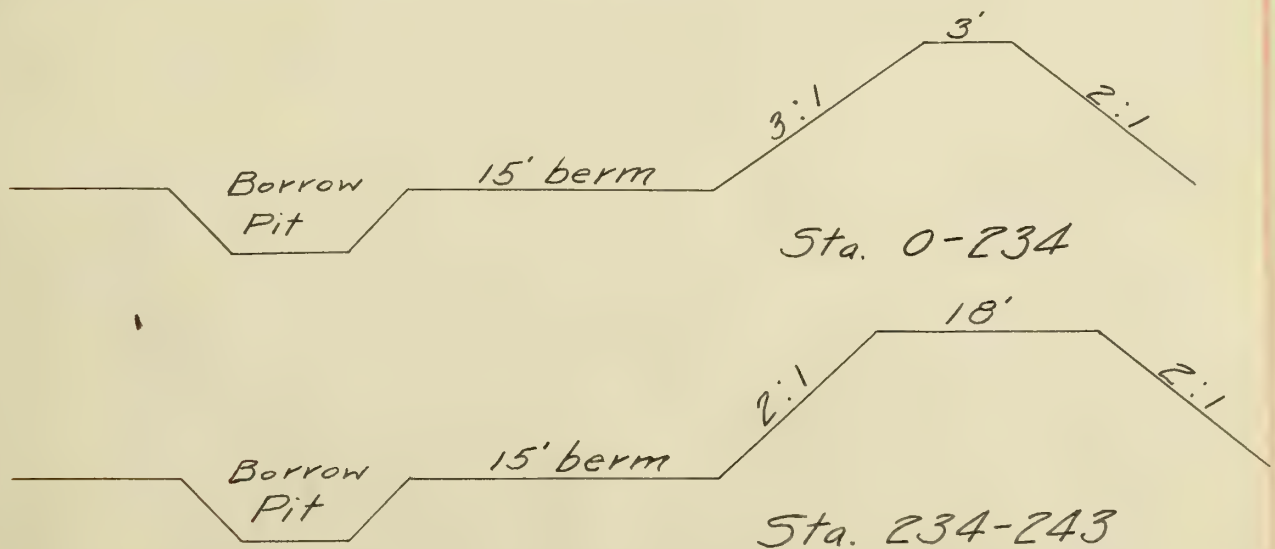
(3) Excavation for the muck ditch.

(4) Excavation for the interior drainage ditches.

Description of Work. The First Division of work comprises that necessary for the completion of the levee as follows:—Strengthening and raising the old levee from the Peoria and Pekin Union Railway grade to a point about 300 feet down the bank of the Illinois River from the place where the levee crosses the public highway leading to the Pekin bridge; thence building a new levee on the inside of the old levee down the right bank of the Illinois River to the mouth of Sammarsh Creek; thence up the left bank of Sammarsh Creek to within about 500 feet of the Toledo, Peoria and Western Railway; from this point the old levee will be strengthened and raised to the place where it crosses the public highway about 500 feet west of the Toledo, Peoria and Western Railway; from there a new levee will be built Northeasterly a distance of about 600 feet along the public highway and will connect with the high land.

From the Peoria and Pekin Union Railway grade to the Toledo, Peoria and Western Railroad, Stations 0 to 234, the levee is to be built three (3) feet wide on top with slopes of three feet horizontal to one foot vertical on the river side and two feet horizontal to one foot vertical on the land side. From the Toledo, Peoria and Western Railway to the end, Stations 234 to 243, the levee is to be built eighteen (18) feet wide on top with side slopes of two feet horizontal to one foot vertical.

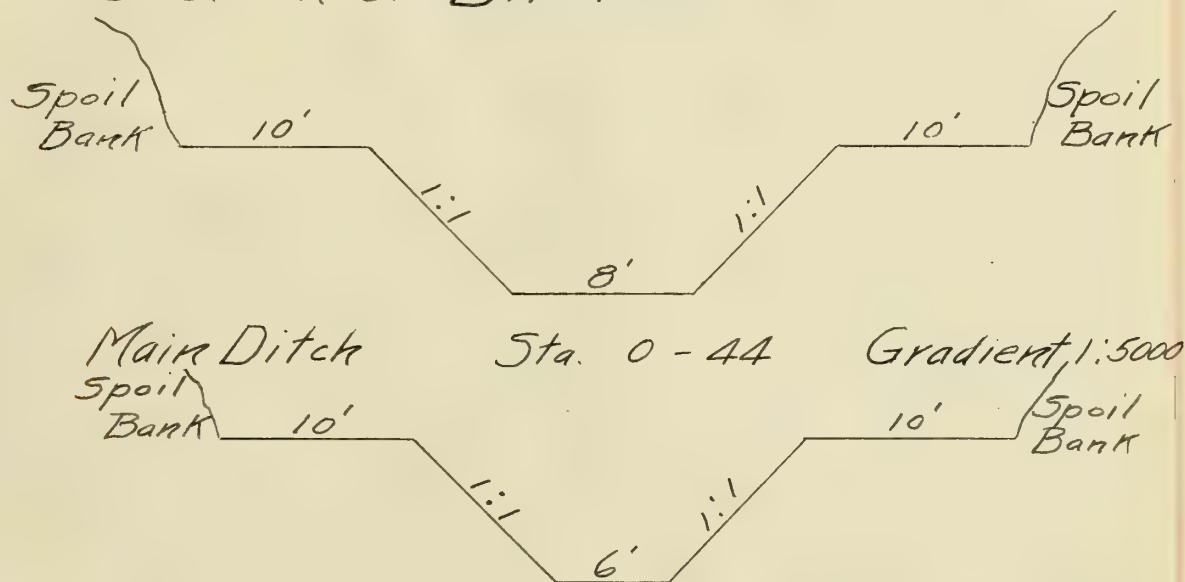
Section of Levee.



The Second Division of the work comprises all that necessary in the construction of the interior drainage ditches and branches.

as shown upon the plans and profiles.

Section of Ditches



Main Ditch Sta. 44 - 111+50 Gradient 1:5000

Branch A 0 - 84+70 1:5000

" B 0 - 35+0 1:5000

35+0 - 65+40 1:2500

" 1 of B 0 - 29 1:5000

Method of Constructing Levee. The ground to be occupied by the levee must be cleared of logs, trash, weeds, grass and leaves to the satisfaction of the Engineer. Following this work, the surface between the slope stakes and to a depth of six (6) inches shall be thoroughly broken and all trees, stumps and buried logs removed outside of the slope stakes.

A muck ditch shall be cut at, or near, the center line of the levee. Said muck ditch shall not be less than five (5) feet deep and not more than six (6) feet wide at the bottom. The side slopes shall be as nearly vertical as practicable, but shall not exceed 1 foot horizontal to 1 foot vertical. The Engineer will set stakes and give grades for the depth of said muck ditch and directions for disposing of the material excavated. After inspecting and measuring, the muck ditch and all other excavations within the base of the levee must be filled with approved material procured from without the base of the levee, and thoroughly tamped while being filled, if such filling be done with scrapers or appliances other than some form of excavating machine which drops the material from a height of fifteen feet or more. All of the foregoing work shall be completed at least 300 feet in advance of the embankment construction.

Whenever by reason of delay, rains or other cause, the surface of the ground upon which the levee embankment is to

be built, or whenever any part of the levee work shall have been suspended so that the unfinished surface is compacted and will not form a bond with the new material to be placed thereon, such surface shall be rebroken as above specified.

In any case where there is special danger of seepage, sheet piling shall be driven of such length and dimensions as shall be required by the Engineer; said piling to be used to form a core for the levee; and reasonable compensation shall be allowed the contractor for the same.

When this preparatory work is finished, the embankment construction shall be commenced and unless otherwise authorized by the Engineer, will be started full out to the slope stakes, and carried regularly up to gross fill in layers not exceeding two (2) feet in thickness. If the work be done by steam shovel or steam dredge instead of by teams, the manner of carrying up the fill shall be to the approval of the Engineer. If dredges are used and the material is so soft that it will not stand to the

full height at the slopes specified, the work may be gone over two or more times to bring the levee to the proper height.

The levee shall be built to such height and width that when fully settled it will be to the full height and width required in the plans, profiles and specifications. Allowance for shrinkage must be so disposed on top and slopes as to give the required width of crown and fill out the slopes to plain surfaces. The contents of the levee computed by the established net grade and slopes only will be paid for.

Only clean earth free from trash and roots shall be placed in the levee. Such earth, as the Engineer may direct, shall be procured from the river side of said levee; if done by teams, no borrow pit shall be made within a zone of twenty (20) feet outside of and adjoining the base of the levee. If the work is done by steam shovel or dredge, a berm fifteen (15) feet wide shall be left at the foot of the levee. No material shall be excavated which would "Under-cut" the outside slope of the levee produced.

No frozen material will be allowed to be deposited in the levee and no levee shall be built or extended upon a frozen surface.

The contractor shall cut down all trees to a distance of 50 feet from the base of the levee wherever so directed by the Engineer.

Method of Constructing Ditches. The ditches provided for shall be constructed with machinery suitable for the work, dug to the depth and bottom width as directed by the Engineer and have side slopes, as nearly as possible, of one foot horizontal to one foot vertical. The excavated material shall be deposited about equally on each side of the ditches having berms of not less than ten (10) feet in width between the outer slopes of the ditches and the bottom slopes of the spoil banks. Openings shall be left in the spoil banks wherever any lateral ditch, branch or natural drain is to enter said main ditch, and at such places as the Engineer may direct.

Estimates of the yardage for the ditches will be made upon the net cross-

section of the ditches as staked out by the Engineer and no allowance will be made for excess of width or depth which may become necessary by reason of the machinery or other apparatus used on the work.

Pumping Station and Plant. The pumping station is to be located near the public road, leading to the Pekin highway bridge across the Illinois River, being upon the South half of the fractional Northwest quarter of Section 24, Township 7 North, Range 7 East of the 4th P.M. at or near where the outlet ditch is constructed. The station is to consist of a brick building on a concrete foundation and of such a form and size as to properly house the plant specified. The pumping plant shall consist of the following :-

(1) Two centrifugal pumps; one to have a capacity of 1000 cubic feet of water per minute, and the other a capacity of 1600 cubic feet per minute against a maximum head of twenty (20) feet. These pumps must be guaranteed to develop a mechanical efficiency of 65 per cent when operating at full capacity against a head of 12 to 15 feet.

(2) Two compound condensing engines, said engines to be direct-connected to said pumps and each engine capable of operating the pump to which it is connected. Said engines shall each be guaranteed to develop 1 H.P. upon not to exceed 22 pounds of steam at 125 pound pressure at the throttle with a vacuum of 24 inches.

(3) Two 110 H.P. fire-tube boilers, each capable of operating the larger engine when driving the pump at its maximum capacity. Said boilers are to be furnished with full flush fronts set in standard brick settings and shall be built in accordance with the rules of the Hartford Steam Boiler Inspection and Insurance Company. The contractor will be required to furnish a certificate of inspection and approval by said company.

(4) One jet condenser of sufficient capacity to receive the exhaust from both engines and maintain a vacuum of not less than 24 inches.

(5) Two four-inch centrifugal pumps to supply the jet condenser and the hot-well.

(6) One hot-well and open heater of not less than 40 cubic feet storage capacity.

(7) One steel stack 36 inches in diameter and 85 feet high to be set upon a concrete or brick base to be furnished by the Commissioners.

(8) The contractor will be required to furnish all the piping, valves and fittings necessary for the steam and water connections complete, for the practical and economical operation of said plant. The plans for setting said machinery and all piping and connecting the same shall be to the approval of the Engineer. The discharge pipe for the main pumps shall be 30 inches in diameter and shall be carried through the levee and to the base of the levee where it will terminate in a concrete abutment and shall be set so as to be submerged when the water is at a stage of 4 feet (442.57 Memphis Datum) on the gauge at the Pekin highway bridge. The contractor will be required to install such meter or meters on the discharge pipe or pipes of said pumps as the Commissioners may furnish.

(9) The foundations for the boilers and all the machinery will be furnished by the Commissioners according to the plans which are to be furnished by the contractor for the pumping station.

(10) Each bidder must give a detailed description of the design, materials and workmanship of each piece of machinery and apparatus offered to be installed in this plant under this proposal.

The above is taken from the "Notice to Bidders" published in October 1906, calling for bids to be opened on November 1, 1906.

CONSTRUCTION

The contract for the improvement of the Pekin and Lamarch Drainage and Levee District was let on August 1, 1906. The Crescent Contracting Co. of Peoria, Illinois received the contract for the construction of the levee and the excavation of the muck ditch and J. Hack and Son of Lowell, Indiana, the contract for the construction of the drainage ditches. The following were the prices in the successful bids :-

			Bid	Engineer's Estimate
Levee				
Levee from P. & P.V. to T. P. & W.	30 700 cu. yds.		12 ⁴ / ₈	12 ¹ / ₂ ⁴ / ₈
" " T. P. & W. " the end	5 000 " "		25	15
Excavation of muck ditch	40 000 " "		11 ¹ / ₂	10
Estimated Cost			\$ 42690	\$ 43125

Ditches	Bid	Engineer's Estimate
Excavation of drainage ditches 100 000 cu. yds.	108 ⁷⁵	10 ⁰⁰
Estimated Cost	<u>\$10875</u>	<u>\$10000</u>
Total Estimated Cost	\$53565	\$53125

At present, the levees and ditches are in the course of construction and are to be finished this year.

Estimate of Cost

The following is an itemized statement by the Engineer of the estimated cost of improvements to levee, ditches and pumping plant as proposed in the plans and specifications:-

Levee work

30 700 cu. yds. of levee-dredge work	@ 122 ¹ / ₂ [¢]	\$38 375
5 000 " " " " team " "	@ 15 [¢]	750
40 000 " " " muck ditch " "	@ 10 [¢]	4 000
		<u>\$43 125</u>

Drainage

100 000 cu. yds. of ditches	@ 10 [¢]	\$10 000
Pumping plant, buildings and outfit complete	@ 40 [¢]	7 000
		<u>\$17 000</u>
Court costs, Attorney fees, Engineering + Incidentals		4 000
Total Estimated Cost		<u>\$64 125</u>

This is equivalent to \$25.65 per acre.

The above estimate does not include the cost of improving the Peoria and Pekin Union Railway levee grade, which cost is borne by the Railway company as per their agreement with the Commissioners of the District.

CONCLUSION

The question naturally arises to land owners and others directly concerned, is the expenditure of so large an amount of money warranted by the benefits derived from the improvement? The answer to this may be found in the following estimate, showing the financial side of the improvement of land found in the Lacey Levee and Drainage District across the Illinois River from Havana, Illinois.

Estimated cost per acre:

Original cost of land	\$ 5.00
Clearing	15.00
Buildings and improvements	10.00
Levee assessment	14.00
Additional assessment necessary	

to construct the levee sufficiently strong to withstand high water in the river

\$ 10.00

Total Cost -

\$ 54.00

Estimated annual expense per acre:

Interest on total cost (\$54) \$ 3.24

Taxes, insurance and repairs 1.00

Pumping tax 1.00

Total annual expense - \$ 5.24

Average annual rental \$ 7.50

Annual net profit \$ 2.26

The productive possibilities of these lands are now being appreciated and renewed interest is being taken in the work of their reclamation. The problems to deal with and the nature of the work necessary to be done are being better understood by landowners, so that more profitable results will doubtless be obtained in the future than have been realized in the past.

MAP OF
PEKIN & LAMARSH
DRAINAGE AND LEVEE DISTRICT

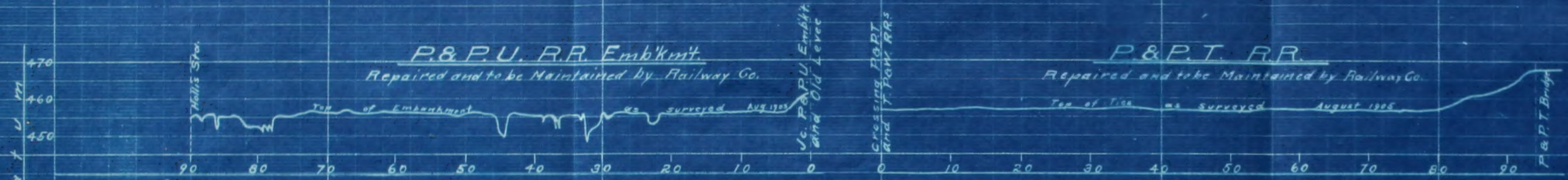
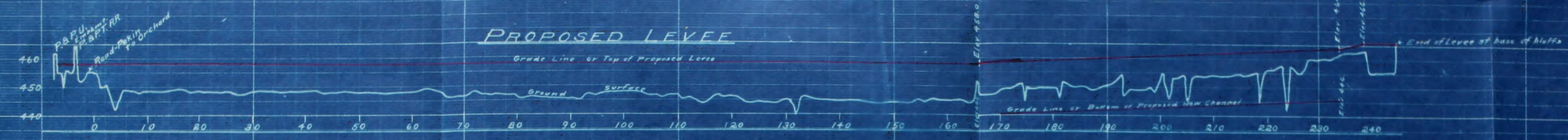
Scale 2 inches = 1 mile

W. L. Prattiman
H. W. McKersich } Commissioners
Henry Ross

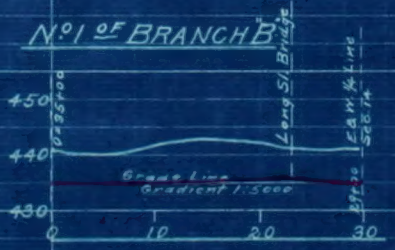
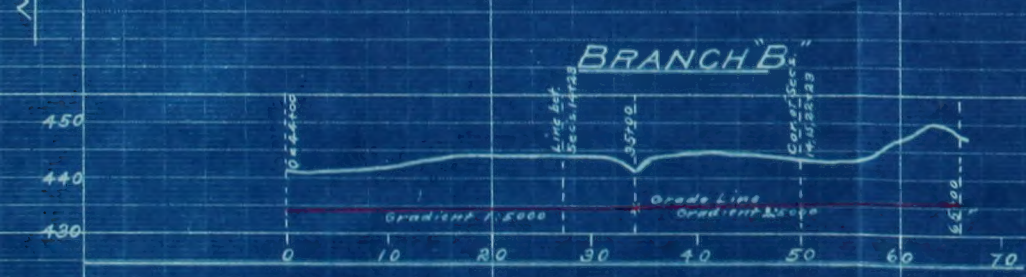
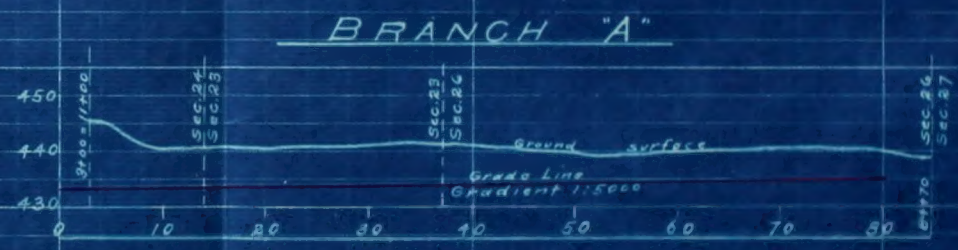
Harman Engineering Co.
Engineers
Peoria, Ill.



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BOTTOM WIDTHS OF DITCHES			
Main Ditch	Sta. 0 to Sta. 44	- 8 Ft.	
" "	" 44 " "	111+50 - 6 Ft.	
Branch "A"	" 0 " "	84+70 - 6 Ft.	
" "B"	" 0 " "	65+40 - 6 Ft.	
No 1 of Branch "B"	" 0 " "	29 - 6 Ft.	



**PROFILES OF
PEKIN & LAMARSH
DRAINAGE AND LEVEE DISTRICT**

Scale { Horizontal 1 inch = 1600 feet.
Vertical 1 " = 30 "

W. L. Prettyman }
H. W. Mattheessen } Commissioners
Henry Roos }
Harman Engineering Co.
Engineers
Peoria, Ill. MA. 7-5-06

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